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L6: Entry 4 of 6 File: USPT Feb 10, 1998

DOCUMENT-IDENTIFIER: US 5717770 A
TITLE: Programmable hearing aid with fuzzy logic control of transmission characteristics

Brief Summary Text (6):
German OS 27 16 336, corresponding to U.S. Pat. No. 4,187,413, discloses a hearing aid wherein the analog audio signal coming from the microphone is converted into a digital signal in an analog-to-digital converter after passing through a low-pass filter and is supplied to a discrete signal processing circuit whose transfer function of the n.sup.th order is formed using parameters stored in an electrically programmable read-only memory (EPROM). The signal processing circuit is controllable with a microprocessor having an arithmetic unit for matching the transfer function to the hearing impairment. The programming can be modified by erasing the read-only memory and by renewed programming. The digital signal modified in this way is then converted into a corresponding analog signal in a digital-to-analog converter, is amplified and is supplied to the earphone.

Brief Summary Text (7):
European Application 0 064 042, corresponding to U.S. Pat. No. 4,425,481, discloses a circuit arrangement for a hearing aid, whereby the parameters of several different environmental situations are stored, for example, in a memory in the hearing aid itself. By actuating a switch, a first group of parameters is called in and, via a control unit, these parameters control a signal processor inserted between microphone and earphone, this signal processor then setting a first transfer function intended for a predetermined environmental situation. The transfer functions of a plurality of stored signal transmission programs can thus be successively called in via a switch until the transfer function that precisely matches the given environmental situation has been found.

Brief Summary Text (8):
It is consequently known to adapt hearing aids to the individual hearing loss of the hearing aid wearer. A setting of the hearing aid for various hearing situations is thereby also provided. Programmable hearing aids offer a plurality of setting parameters that are intended to enable an optimum matching of the electro-acoustic behavior of the hearing aid to the hearing impairment to be compensated.

Detailed Description Text (13):
FIG. 13 shows a simple fuzzy logic set of rules and its fundamental processing. A first step for the implementation of a fuzzy logic structure is the definition of the linguistic variables for its input and output quantities. The terms for each of these quantities are entered relative to a numerical value scale. Variable quantities are shown over the x-axes of the illustrated coordinate axes, whereby the value .mu. in the y-axis indicates the degree of satisfaction, or truth, of the respective statement.

Detailed Description Text (18):
Fuzzification: graphing the input values relative to the linguistic variables, i.e. calculation of the values of the membership functions of each and every input quantity for the individual terms of the relevant linguistic variables. The formation of the complement of the identified value may possibly be necessary.

Detailed Description Text (25):
Unit current signals 22, 22' or 23, 23' are respectively supplied to the transistor circuits 26, 27. A predetermined unit current signal/reference signal can thereby be duplicated into corresponding unit current signals 22, 22' or 23, 23' via a current mirror of this type. The unit current value of these reference current signals corresponds to the maximum value 1 of the current signals 19, 19', 19" or 20, 20', 20".

By a corresponding dimensioning of the current mirrors 26, 27 (design of the transistor size relationships) the supplied current signals 19, 19', 19" or 20, 20', 20" are mirrored from the input side onto the output side in the ratio 1:a and the unit current signals 22, 22' or 23, 23' are mirrored in the ratio 1:b. Due to the blocking effect of the diodes 44 or 45 in one direction, the current transfer relationships respectively shown in FIGS. 5 and 7 arise. The quantities a and b represent the transistor size relationships in the circuits 26, 27. At the same time, the quantities a and b appear in the characteristics of FIGS. 5 and 7 that belong to the circuits 26, 27. In accord therewith, the respective output values 24, 25 of the current in the circuits 26 and 27 are equal to zero until the value of the current of the supplied current signals 19, 19', 19" or 20, 20', 20" exceeds the value (b/a).multidot.(22, 22') or, respectively, the value (b/a).multidot.(23, 23'). The output values 24, 25 of the current then increase linerally with the slope a, or decrease linerally with the slope a. The design of the transistor size relationships a or b of the transistor circuit constructed with N-MOS and P-MOS transistors defines the curve of the respective output value 24 or 25 of the current. On the basis of a superimposition of the sub-segments formed by the circuits 26 and 27 (which corresponds to connecting the respective, correspondingly dimensioned circuit parts in parallel), every desired membership function can be approximated from straight segments. The circuit outlay decreases as the the approximation becomes coarser, i.e. as fewer straight segments are employed.

L6: Entry 5 of 6 File: USPT May 21, 1996

DOCUMENT-IDENTIFIER: US 5519298 A
TITLE: Abnormality detection method, stability degree determination method and operation control method for mechanical equipment

Abstract Text (1):
The value of a variable reflecting the operating condition of mechanical equipment is continuously detected as operation condition data. A long period average value of the operating condition data detected in long reference period, and a short period average value of data detected in a short analysis period ending in the present time are calculated. Just how much the short period average value differs from the long period average value is adopted as an index of abnormality and using this index, it is possible to ascertain abnormal operating conditions regardless of the absolute value of the variable detected. The above short period average value, long period average value and standard deviation thereof are applied to a first fuzzy membership function for calculating the degree of stability of the mechanical equipment therefrom. Furthermore, the degree of stability is then applied to a second fuzzy membership function for calculating the amount by which the operating parameter of a control factor of the mechanical equipment must be adjusted in order to achieve a desired degree of stability. Thus the mechanical equipment can be controlled for optimum operation.

Brief Summary Text (16):
In other words, just how much the operating condition data at the present time differs from operating condition data which has Said long period average value as it's average value, is applied to first fuzzy membership function to obtain a numerical value reflecting the degree of stability and by doing so, it is possible to assuredly ascertain abnormal conditions regardless of the absolute value of the operating condition data.

Brief Summary Text (17):
According to the operation control method for controlling mechanical equipment according to the present invention, the level of at least one variable reflecting the operating condition of the mechanical equipment is continuously detected as operation condition data. Then, (i) a short period average value of operation condition data detected in an analysis period of specified duration ending in the present time, and (ii) a long period average value of operation condition data detected in a reference period ending in the present time of a specified duration longer than that of the analysis period are calculated from the operation condition data. Next, these short and long period average values are applied to a predefined first fuzzy membership function for calculating a degree of stability of the mechanical equipment therefrom, and the degree of stability calculated above is applied to a second fuzzy membership function for calculating the amount by which the operating parameter of at least one control factor of the mechanical equipment must be adjusted in order to achieve a desired degree of stability. The mechanical equipment is then controlled n accordance with the output from the second fuzzy membership function.

Drawing Description Text (7):
FIG. 6 is a graph of the fuzzy membership function showing the relationship between the degree of stability and the mill electrical power.

Detailed Description Text (6):
The operating condition of the roller mill having the structure described above can be inferred for example, from the detection of the level of vibrations using a vibration pick-up 2 fixed to said roller mill, and/or the mill electrical consumption detected by electric power meter 6 fixed to motor 21 which drives the rotation of the table 14. The operation of the roller mill is controlled by adjusting the operating parameters of control factors of the roller mill in accordance with the detected operating condition

data. Examples of such control factors are the amount of raw material supplied by conveyor 12, the amount of exhaust wind provided by exhaust fan 17, and the crushing pressure applied by rollers 15, etc.

Detailed Description Text (12):
In the above equation, x is a set warning parameter preset in accordance with the type of roller mill and the type of operating condition data, The total value of the right hand side of equation (1) is the abnormality reference value. If the above equation is satisfied, control device 4 effects control comprising adjustment of the operating parameters of mill control factors such as raw material feed amount, in order to evade abnormal conditions.

Detailed Description Text (21):
Steps S1-S5 are identical to those of the abnormality detection method. In addition to these steps, the short period average value, a of vibration data detected in an analysis period comprising the sixty second period ending in the present time as calculated in step S2, and the long period average value, .mu., of vibration data detected in a reference period comprising the twenty minute period ending in the present time together with the standard deviation thereof, .sigma., as calculated in step S3, are input into a predefined fuzzy membership function (first fuzzy membership function) and the degree of stability is output as a numerical value (S6).

Detailed Description Text (24):
As described above, according to the degree of stability determination method of the present invention, a fuzzy membership function is used to calculate a degree of stability for the operating condition in the form of a numerical value between 0-100 depending on the amount by which the detected vibration data differs from the average level. Thus it is possible to express changes in the operating condition numerically, regardless of the absolute value of the detected data.

Detailed Description Text (27):
FIG. 5 is a block diagram showing the sequence of steps occurring within a data processing unit used to effect the operation control method applied to the roller mill. FIG. 6 is a graph of the fuzzy membership function showing the relationship between mill electrical power and the degree of stability.

Detailed Description Text (29):
For example, consider the case when the roller mill is operated at an electrical power value set at 3000 kW. If the mill was then judged to be unstable (i.e. if the mill looks as though it is going to stop), the operator would lower the set value of the electrical power to 2700 kW. In other words, in order to return the degree of stability to 100 from 0, the set value of the mill electrical power is reduced by 10%. If the fuzzy membership function showing this relationship were drawn as a graph, it would look like that shown in FIG. 6. This function may also be expressed by the following equation (2).

CLAIMS:

6. An operation control method for controlling mechanical equipment comprising the steps of:

continuously detecting the level of at least one variable reflecting the operating condition of the mechanical equipment as operation condition data;

applying (a) a short period average value of said operation data detected in an analysis period of specified duration ending in a predetermined time, and (b) a long period average value of said operation data detected in a reference period ending in the predetermined time of a specified duration longer than that of said analysis period, to a predefined first fuzzy membership function for calculating the degree of stability of said mechanical equipment therefrom;

applying the degree of stability calculated above to a second fuzzy membership function for calculating the amount by which the operating parameter of at least one control factor of the mechanical equipment must be adjusted in order to achieve a desired degree of stability; and

controlling said mechanical equipment in accordance with the output from said second fuzzy membership function.